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Association of Environmental Indicators with Teen Alcohol Use and Problem Behavior: Teens' Observations vs. Objectively-Measured Indicators

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Abstract

Most prior studies use objectively measured data (e.g., census-based indicators) to assess contextual risks. However, teens' observations might be more important for their risk behavior. Objectives: 1) determine relationships between observed and objective indicators of contextual risks 2) determine relations of observed and objective indicators with teen alcohol use and problem behavior. Teens aged 14–16 (N=170) carried GPS-enabled smartphones for one month, with locations documented. Ecological momentary assessment (EMA) measured teens' observations via texts regarding risk behaviors and environmental observations. Objective indicators of alcohol outlets and disorganization were spatially joined to EMAs based on teens' location at the time of the texts. Observed and objective disorganization, and objective indicators of alcohol outlets were related to alcohol use. Observed disorganization was related to problem behavior, while objective indicators were unrelated. Findings suggest the importance of considering teens' observations of contextual risk for understanding influences on risk behavior and suggest future directions for research and prevention strategies.

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Keywords

neighborhood context; observations; GPS; alcohol outlets; adolescent alcohol use

Introduction

Based on ecological theories that underscore the importance of individuals' embeddedness in their social context, development must be considered within its context (Bronfenbrenner, 1979). Social-ecological theories, such as developmental system theories, posit that while individuals are influenced by their environments, they also actively select and shape their environments (LaScala et al., 2005, Bronfenbrenner and Morris, 2006, Urban et al., 2009, Bronfenbrenner, 1979). Measuring individuals' exposure to physical and social environments is a difficult task. Most research on neighborhood contextual risks and teen problem behavior relies on the use of objectively measured data (e.g. Census based measures, planning and zoning data, and other routinely collected secondary sources) to assess neighborhood characteristics (e.g., Burton and Jarrett, 2000, Leventhal and Brooks-Gunn, 2000, Cook et al., 2015, Wright et al., 2014). However, these global indicators may not provide enough detail to adequately illuminate the link between contextual risks and teen outcomes. Teens' own observations of their environment might be more important in determining their behaviors than appraisals made by researchers, since residents and researchers often define the same neighborhoods quite differently (Burton & Price-Spratlen, 1999). This study compares observed and objectively measured indicators of environmental exposures for teens, and compares relationships with risk behaviors. Although biases may also exist in data assessed by researchers, we use the term "objectively" measured data to describe data based on records (e.g., census data, alcohol outlet data), rather than by residents' observations, in line with prior work (Goldman-Mellor et al., 2016).

Environmental contextual risks influence teen risk behaviors

Contextual risks such as social disorganization, defined as residents' difficulty preserving social and physical order (Shaw and McKay, 1942), have been related to youth risk behavior (Byrnes et al., 2007, Leventhal and Brooks-Gunn, 2000). Disorganization may lead to risk behavior for teens because this disorder may interfere with processes that encourage healthy behavior (Sampson and Groves, 1989, Wilson, 1987, Brody et al., 2001). Structural social characteristics of neighborhoods (e.g., poverty) may disrupt neighborhood social organization, resulting in problem behaviors (Shaw and McKay, 1942, Sampson and Groves, 1989), and as such, these factors are often used as proxies for disorganization (Freisthler, 2004, Ennett et al., 1997, Lee and Cubbin, 2002). Prior studies provide evidence of a relationship between greater disorganization and increased alcohol, tobacco, and other drug (ATOD) use and other youth risk behaviors, such as delinquency (Xue et al., 2007, Byrnes et al., 2007, Tobler et al., 2009, Wiehe et al., In press). Neighborhood disorder has also been linked to mental health, such as depressive symptoms (Wight et al., 2006, Hurd et al., 2013), and biological indicators of stress, such as lower levels of serum cortisol in children (Dulin-Keita et al., 2012).

Higher concentrations of alcohol outlets in residential neighborhoods have been related to youths' alcohol use, heavy drinking, and drinking problems (e.g., Truong and Sturm, 2009, Kypri et al., 2008, Treno et al., 2008). The literature emphasizes two possible mechanisms by which these relationships might arise. First, alcohol outlets may be indicators of disorganization stemming from a lack of normative controls against problem behaviors (Gruenewald, 2007). Second, although teens are less likely to obtain alcohol from outlets as from other sources (Hearst et al., 2007, Paschall et al., 2007), exposure to outlets may influence teen use (Pasch et al., 2009) through greater access for their social contacts (Reboussin et al., 2011) and by changing perceptions of alcohol use as more normative (Pasch et al., 2009).

Most prior research has measured exposure to contextual risks with administratively defined units (e.g., census tracts), limited to an area around teens' homes (Basta et al., 2010, Wiehe et al., 2008, Feng et al., 2010, Leal and Chaix, 2011). However, these units may not reflect the spaces where teens actually spend their time, an issue referred to as the uncertain geographic context problem (Kwan, 2012). For example, many teens spend half or more of their time away from home (Wiehe et al., 2008), and teens spend time in locations that cut across traditional definitions of neighborhood (e.g., census tract) (Basta et al., 2010). Activity space can be defined as the geographic area an individual moves within during their daily activities (Gesler and Meade, 1988, Mason, 2010). Activity space may provide a more accurate measure of contextual risks (Kwan, 2012). Global positioning system (GPS) devices can be used to assess activity space, by using detailed data to determine actual physical spaces and paths that people spend time in during their day (Wiehe et al., 2008, Maddison et al., 2010, Zenk et al., 2011, Cohen Hubal et al., 2000). For example, a study of substance issues among adults used GPS to assess locations and Ecological Momentary Assessment (EMA) to assess cravings, mood, and stress, finding that areas rated by research staff observers as more disordered were counterintuitively related to more positive mood, fewer cravings, and lower stress (Epstein et al., 2014). Another study using GPS-EMA techniques among a sample of mostly African-American adolescents assessed activity space disorder via GPS linked to census measures, and used EMA to assess mood, behavior, and peer activities (Mason et al., 2016). Results showed that peer networks moderated the association between parent relationship and substance use for adolescents with high risk activity spaces. Another study using the same sample (Mennis et al., 2016) found census measures of relative disadvantage associated with substance use, feelings of safety, and stress. The relationship between stress and relative disadvantage was moderated by substance use such that greater substance use increased the effect of relative disadvantage on stress levels.

Conceptualizations of contextual risk

Neighborhood as physical site

Most studies of neighborhood effects on youth outcomes conceptualize the neighborhood as a physical site (e.g., census tracts, zip codes) (Burton and Jarrett, 2000). Studies defining neighborhoods as a physical site frequently use objectively measured indicators of contextual risk. Objectively measured indicators have been associated with teen risk

behavior, such as alcohol use and other problem behavior (behaviors that might cause teens to get in trouble with the law (e.g., sold drugs, got into a fight), with school, or with their parents) (e.g., Treno et al., 2008, Cook et al., 2015, Wright et al., 2014). For example, higher neighborhood socioeconomic status (SES) was related to higher rates of drunkenness in Asian American teens in a longitudinal study (Cook et al., 2015). Another study found that greater density of off-premise alcohol outlets is associated with higher teen perceptions of alcohol availability and use of alcohol from off-premise outlets (Treno et al., 2008). Concentrated disadvantage (e.g., indicators of low SES such as the percentage in poverty and percentage unemployed) in census blocks has also been related to young adult reoffending (Wright et al., 2014).

Defining neighborhoods in this way has advantages of being able to use designated (and typically standardized) boundaries to denote neighborhoods, permits calculations of neighborhood characteristics across a standard physical area, and allows the use of Geographic Information Systems (GIS) techniques. Comparisons of neighborhood characteristics across a large number of neighborhoods and families is also facilitated.

Observations of neighborhoods

An alternate approach uses residents' observations of their own neighborhoods to determine neighborhood borders and characteristics (Burton and Jarrett, 2000). This approach is consistent with contextual theories that underscore the role of the individual's interpretation of and interaction with the environment (Bronfenbrenner, 1992, Jessor et al., 1995). Given that residents' observations of their neighborhoods often differ from objectively measured indicators, their observations may be better predictors of outcomes (Burton and Price-Spratlen, 1999). For example, census tracts are frequently used to demarcate neighborhood boundaries, but they are often much larger than those defined by youth (Burton and Price-Spratlen, 1999). Some studies have found teens' views of contextual risks related to their risk behavior (e.g., Friese et al., 2015, Fite et al., 2010, Byrnes et al., 2007). In a study of Native American teens, perceptions of neighborhoods with less normative restrictions on ATOD use, greater observed neighborhood disorganization, and less observed police involvement were all related to higher drinking rates (Friese et al., 2015). A study of mostly African-American teens found that protective peer networks mitigated the impact of perceived activity space risk on substance use (Mason et al., 2015). Findings also showed that peer networks moderated the effect of perceived activity space risk on marijuana use, but for boys only. Not only have teen observations been found to be important, but caregiver observations of unsafe neighborhood conditions have also been related to youth aggression (Fite et al., 2010).

Objectives

Few studies have compared objectively measured indicators and observed contextual risks. A study of low-income women (Elo et al., 2009) found that objectively measured indicators (crime and census measures) of neighborhood crime and disorder were significant predictors of women's perceptions of their residential census tracts. A study of Illinois adults (Ross and Mirowsky, 2001) found that objectively measured neighborhood disadvantage (census

indicators) predicted perceived neighborhood disorder and fear, which was related to worse physical health outcomes.

However, the relative influence of objectively measured and observed indicators of contextual risks in spaces where teens spend time, in relation to their risk behavior has been little examined. The objectives of this paper are: 1) to determine the relationship between observed contextual risks and more traditionally used objectively measured indicators of contextual risks, and 2) to compare observed risks to objectively measured indicators of contextual risks in activity spaces to determine which indicators are most related to teen alcohol use and problem behavior. In comparing observations to objectively measured indicators that are more traditionally used in contextual risk research (e.g., census indicators), we will examine whether including observations provides more information to aid in understanding teen risk behaviors.

If objectively measured indicators are as strongly related to teen problem behaviors as observations of risk are, then implications may be to focus time and resources on this type of data collection, as it is less expensive and more efficient to obtain than teen observations. However, if observations of risk are more strongly related to teen behaviors, this could have implications for prevention strategies. In order to prevent problem behaviors related to risky contextual exposures, it is first necessary to understand the exposures that teens observe, as their views may differ from designations of risk by researchers.

Materials and Methods

Procedures

These analyses used the first 170 cases from a longitudinal study currently in progress (the Healthy Communities for Teens study), examining neighborhood contextual risks and ATOD use and problem behavior in teens aged 14 to 16 at baseline. This age range was chosen because it represents a transitional period when teens greatly increase ATOD use (SAMHSA, 2014) and freedom to explore different contexts (Kelley-Baker and Voas, 2009, Voas and Kelley-Baker, 2008).

We recruited a convenience sample of teens from 10 cities in the San Francisco, CA area. The 10 cities were drawn from a random sample of 50 California cities with populations 50,000–500,000 with no adjacent cities (Gruenewald et al., 2014). Cities this size account for about 70% of the state population. The 50 cities, according to 2000 census data, had variation in population characteristics typical among cities this size. The 10 cities selected for the current study were chosen based on proximity to the research center and diversity in SES, race, and social disorganization.

We used several methods for recruitment. The majority (59.6%) were recruited via telephone. Households were sampled from a purchased list of phone numbers (50% cell phone numbers) based on existing phone exchanges and cell phone billing zip/address information in the target cities from which most non-working, business, fax, and modem phone numbers had been purged. The remaining participants were recruited via other methods: 11.9% Facebook, 2.2% Instagram, 3.5% Craigslist, 15.1% paid peer referrals,

3.2% flyers posted, and 4.5% from presentations at community venues (e.g., community centers). During contact, research staff first spoke with the parent to screen for eligibility and obtain consent. Eligibility criteria included: within targeted community, youth age 14–16, have an email address, and English or Spanish speakers. Although our target ages were 14–16, four teens who were about to turn 14 within the next month were allowed to join the study, and one teen turned 17 after recruitment, but before completing surveys.

Participants were provided with GPS-enabled smartphones (Apple iPhone5c) for their one-month study period. We recorded their latitude and longitude approximately every 60 seconds using ActSoft's Comet Tracker (ActSoft Inc., Tampa, FL), with location data automatically sent to a secure server. We used Ecological Momentary Assessment (EMA) to collect information regarding current behaviors and observations, sending brief text-prompted web surveys twice after school and in the evening on Thursday and Friday, and during the same time period on Saturday to capture current behaviors and observations. EMA survey timing was able to be tailored to meet the needs of each participant, but standard times were 4:00 p.m. and 9:00 p.m.

Teens received \$2 per text-prompted web survey completed (24 texts sent), and received a \$35 bonus for equipment return in good condition (i.e., phone, headphones, and charger), for a possible total of \$83. Teens were also provided with unlimited talk, text, and internet use on the phones during the study period. In addition, teens could also earn up to \$60 for referring other eligible teens to the study. Up to four eligible teens were allowed, for \$15 per referral. Parental consent and teen assent were obtained. All study procedures were approved by the institution's Institutional Review Board. Teens generally complied with the study protocol. All but one participant returned the phone and charger, and on average participants completed 68.4% of texts received, with over half (51.4%) completing at least 75% of texts.

About half (54.7%) of the participants were female. The average age was 14.8 (SD = .84). Participants were 52.4% White, 4.7% Asian, 11.8% African-American, 0.6% Pacific Islander, 24.7% multi-ethnic, and 5.9% Other/unreported. One fifth (21.8%) were Hispanic/Latino.

Measures

Risk Behaviors—Risk behaviors assessed were 1) alcohol use and 2) other problem behaviors. Teens were asked if they had consumed alcohol since the last text. Response options were (a) no, (b) yes, since the last text, and (c) yes, doing this right now. The two “yes” responses were combined, and a summary variable was created indicating the percent of texts where the participant reported using alcohol over the month. Three items created for the study assessed problem behaviors since the last text. Items asked whether they had done anything that might get them in trouble with the law (for example, shoplifted, sold drugs, threatened someone, got into a fight), with school, or with their parents. Response options were (a) no, (b) yes, since the last text, and (c) yes, doing this right now. Items were dichotomized so that the two “yes” responses were combined, and then dichotomized items were summed across the three items to create an index reflecting the number of behaviors in which the respondents had engaged over the month ($\alpha = .71$). Index scores were then averaged across texts.

Observations of contextual risk

Social disorganization: Five items adapted from Perkins et al (1990) were used to assess social disorganization. Four items asked teens how much specific issues were present in the area where they were right at that moment: 1) property damage/vandalism, 2) litter/trash on streets/sidewalks, 3) drug use or drug dealing, and 4) groups of young people hanging around. Response options were 1 = none or hardly any to 5 = a lot. One item asked how safe they felt right now (1 = not safe at all to 5 = very safe). This item was reverse coded and then all five items were averaged to create an observed social disorganization scale, where higher scores indicated greater observed disorganization. Feelings of safety was included in the same scale with the other four items based on prior studies that included feelings of safety in measures of disorganization (e.g., Elliott et al., 1983, Arthur et al., 2002). Cronbach's $\alpha = .77$, indicating adequate internal consistency reliability. Observed social disorganization scores were aggregated over the month.

Alcohol outlets: One item assessed the teen's awareness of alcohol outlets in their activity space, asking whether they could see a liquor store or bar, or convenience store or grocery that sells alcohol (Yes/No). The percent of texts over the month in which teens' were aware of an alcohol outlet was calculated.

Objectively measured indicators of contextual risk—Two objectively measured indicators were assessed: 1) social disorganization and 2) alcohol outlets.

Social disorganization: Low SES was used to assess social disorganization. Using American Community Survey 5-year estimates for 2009–2013, we created an index reflecting SES indicators of disorganization at the Census block group level. The index was calculated as the sum of the following proportions: overall unemployment, households receiving public assistance, low income persons (<100% poverty level), low income persons (100%–149% poverty level), high school dropouts, female-headed households, renter-occupied houses, and moved in the previous year. Moderate internal reliability consistency was found ($\alpha = 0.76$). This approach is consistent with measures of SES used in prior studies (Leventhal and Brooks-Gunn, 2000, Lynam et al., 2000, Andreias et al., 2010). We spatially joined the SES score for the Census block group in which participants were located at the time EMA surveys were submitted. To aggregate these values within participants, we calculated an average of the SES scores across all submitted EMA surveys. We standardized these scores at the person level prior to analysis.

Alcohol outlets: We geocoded all venues licensed to sell alcohol based on 2013 data from the California Department of Alcoholic Beverage Control, then calculated counts of bars (license types 23, 40, 42, 48, 61, and 75) and off-premise outlets (20 and 21). We assigned binary indicators to each EMA identifying whether either of these outlet types were within 50m, 100m, and 200m buffers of the participant's geographic location at the time the EMA survey was submitted. We then calculated the proportion of EMA surveys at which participants were proximate to any alcohol outlet at these buffer distances.

Analyses

The units of analysis were the 170 participants

Descriptive analyses were conducted to examine frequencies and means for key variables. Bivariate correlations were then conducted to assess relationships among observed and objectively measured predictors, and between predictors and outcome variables. We used zero-inflated Poisson models for (i) the proportion of EMA surveys in which the participants indicated they had consumed alcohol, and (ii) the mean number of problem behaviors reported. Given concerns related to multi-collinearity, we did not combine the teens' observations and objectively measured exposure to alcohol outlets and neighborhood disorganization within the same models. Rather, we related these exposure variables to the outcomes in separate models. The models for alcohol consumption accounted for zero-inflation based on participants' self-report of whether they had ever consumed alcohol during a baseline survey (completed prior to the month-long study period). Similarly, the models for problem behaviors accounted for zero-inflation based on self-reports of whether they had ever engaged in problem behaviors during the baseline survey. All models adjusted for participant sex, age, and ethnicity. We used a Vuong likelihood ratio test to assess fit for the zero-inflated Poisson model compared to a regular Poisson model (Vuong, 1989).

Results

Descriptive Analyses

Risk behaviors—Based on EMA data, almost one quarter (22.9%) of teens reported drinking in at least one text. Half (52.9%) of teens reported any problem behavior in any of the texts over the month. One quarter (28.8%) reported doing something that could get them in trouble with the law, one quarter (30.6%) reported doing something that could get them in trouble with school, and almost half (49.4%) reported doing something that could get them in trouble with parents.

Observations of contextual risk—*Social disorganization*: In EMA's, teens reported average scores of 1.59 (SD = 0.51) for disorganization in their immediate environment at the time of the text (range = 1 to 3.02), indicating that teens tended to report low levels of disorganization in areas where they spent time. *Alcohol outlets*: On average, teens reported seeing an alcohol outlet in 13.1% of texts (SD = 17.1), with a range of 0 to 100%.

Objectively measured indicators of contextual risk—*Social disorganization*. About one fifth (22.1%) of participants were exposed to neighborhoods with low SES scores worse than the state median, indicating that teens tended to spend time in less disorganized neighborhoods. *Alcohol outlets*: On average teens were exposed to alcohol outlets (off-premise and bars) at the 50m buffer at the time of 2.9% of texts (SD = 0.07), 8.1% (SD = 0.16) of texts at the 100m buffer, and 19.2% (SD = 0.27) of texts at the 200m buffer.

Bivariate Analysis

Correlations between key variables are shown in Table 1. Observations of alcohol outlets were significantly and positively correlated with observations of greater social

disorganization, and objectively measured indicators of social disorganization and alcohol outlets (100m and 200m). Objectively measured indicators were correlated with each other as well. Observations of social disorganization were significantly positively correlated with objectively measured indicators of disorganization. Alcohol use and problem behavior were significantly correlated with each other.

Teens' observations of disorganization were significantly positively related to both alcohol and problem behavior. Only objective indicators of alcohol outlets at 100m and 200m were correlated with alcohol use, but no objective indicators were related to problem behavior.

Multivariate Analysis

Results for the zero-inflated Poisson models are presented in Table 2. Teen observations and objective indicators of disorganization, and objective indicators of alcohol outlets (100m and 200m only) were positively significantly related to alcohol use. Teen observations of disorganization were positively significantly related to problem behavior. Vuong test statistics were positive ($p < 0.05$) for all models, indicating that zero-inflated Poisson models provided a better fit than regular Poisson models.

Conclusions

Findings emphasize the importance of teens' own observations of their environments for their risk behaviors. For alcohol consumption, both levels of observed disorganization in places where teens spend time as well as objectively measured data reflecting disorganization and alcohol outlets (100m and 200m only) in these same spaces were related to alcohol use. However, only teens' observations of disorganization were related to problem behavior, while objectively measured data for this construct was unrelated. These findings are consistent with contextual theories that focus on the individual's own interpretation of their environment (Bronfenbrenner, 1992, Jessor et al., 1995), and prior studies showing that teens' observations of contextual risks are related to their risk behavior (Friese et al., 2015, Byrnes et al., 2007). Based on early work by Lerman (1967), it may be that teens who are aware of disorganization in their activity spaces may be so because they have already begun engaging in problem behaviors that expose them to these contextual risks. If this is the case, then observed disorganization in places where teens spend time may be an indicator for greater potential problem behavior in teens. This also raises the issue of selection vs. influence. Future studies should attempt to differentiate whether teens prone to problem behaviors choose to be in more disorganized neighborhoods, or whether being in those neighborhoods influence teens towards problem behaviors.

Given that objectively measured indicators were unrelated to problem behavior, our findings highlight the importance of assessing teens' observations of contextual risks in places where they spend time. Although observations and objectively measured indicators of disorganization were significantly correlated with each other, only observations were related to problem behavior. This is consistent with research showing that residents and researchers tend to rate the same neighborhoods quite differently (Burton and Price-Spratlen, 1999). Even if researchers denote a context as a low-problem area based on a variety of indicators, if youth interpret their environment negatively, their behavior may be affected.

Limitations of the study should also be noted. Incongruent geographic resolution may partly explain our results, because the highly resolved GPS data will be affected by aggregation bias to a lesser extent than the block group level objective measures. Objectively measured indicators of social disorganization are necessarily calculated within polygons and are commonly used to measure the neighborhoods in which individuals are located, so we considered it appropriate to use these objectively measured measures as the comparison for this analysis. Methods are available to describe social disorganization at higher geographic resolutions (e.g., Sampson et al., 1997, Furr-Holden et al., 2008); a pertinent question for future research would be to examine relationships using these objective measures of neighborhood conditions.

Data were cross-sectional, so causality cannot be determined. However, data are part of an ongoing, longitudinal study, so further waves will be available to examine relationships over time and provide stronger evidence of possible causation. Common method variance is another potential limitation (Doty and Glick, 1998). Since teens reported their own behavior and also reported their observations of the context where they were spending time, it is possible that observations were more strongly related to teen behaviors because the same person is more likely to respond to multiple scales in the same way. For example, people with more problem behaviors might see the world as more disorganized. However, although common method variance can inflate relationships reported by the same respondent, it can also deflate relationships observed, depending on the scales used to assess each construct (Doty and Glick, 1998).

This research has implications for prevention programming. An important focus may be on helping parents to understand what their teens observe in the contexts where they spend their time and becoming aware of the risks they may be exposed to in their daily activities. Parents' awareness of youth stressors is related to more protective parenting strategies and better youth adjustment (Hartos and Power, 1997). Findings also suggest that teens' observations of contextual risk in spaces where they spend time should at least be included in studies along with objectively measured data in considering teen risk behaviors. However, it is important for researchers to also consider drawbacks to including teens' observations, such as increased time, expense (although using teens' own cell phones could mitigate this), and possibility for self-report bias, as compared to objectively measured data.

Another area of importance is that not all teens exposed to high risk environments engage in risky behaviors and further work is needed to determine how some teens remain resilient in disruptive environments and remain relatively problem free. Future studies that develop a better understanding of how environments are destructive and what other family and neighborhood impacts can counter these neighborhood influences are needed, such as extending prior work showing the protective effect of family support on antisocial behavior for minority children living in highly disordered neighborhoods (Schofield et al., 2012). Future studies should also examine the factors that influence teens' observations of contextual risk. For example, certain experiences in specific contexts such as spending time with deviant peers or victimization experiences may be important influences on how teens view their environments. Future directions should also include the possible mediating role of teens' observations in the relationship between environmental characteristics and behavioral

outcomes, and moderating factors of this relationship. In addition, future work should explore influences of differing behavior and activity patterns on weekends vs weekdays. These directions may lead to a more comprehensive approach to preventing youth alcohol use and problem behavior within communities.

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Table 1

Bivariate correlations among key variables (N=170).

Variable	1	2	3	4	5	6	7	8
1. Alcohol use	1.00							
2. Problem behavior	0.41 ***	1.00						
3. Observed disorganization	0.37 ***	0.34 ***	1.00					
4. Objective indicators of disorganization	0.05	-0.03	0.34 ***	1.00				
5. Observed alcohol outlets	0.09	0.12	0.42 ***	0.32 ***	1.00			
6. Objectively measured alcohol outlets (50m)	-0.03	0.00	0.12	0.13	0.10	1.00		
7. Objectively measured alcohol outlets (100m)	0.18 *	0.03	0.25 **	0.22 **	0.38 ***	0.59 ***	1.00	
8. Objectively measured alcohol outlets (200m)	0.22 **	-0.03	0.24 **	0.34 ***	0.44 ***	0.37 ***	0.62 ***	1.00

Note.

* p < .05,

**

p < .01,

p < .001

Table 2

Adjusted incidence rate ratios from zero-inflated Poisson models for the proportion of EMA responses in which participants reported consuming alcohol and problem behaviors

	Alcohol Consumption ^a				Problem Behaviors ^b			
	IRR	(95% CI)	p-value		IRR	(95% CI)	p-value	
Observed disorganization	<i>2.42</i>	<i>2.09</i>	<i>2.81</i>	<i>< 0.001</i>	<i>2.87</i>	<i>1.63</i>	<i>5.07</i>	<i>< 0.001</i>
Objective indicators of disorganization (standardized)	<i>1.25</i>	<i>1.10</i>	<i>1.41</i>	<i>0.001</i>	0.98	0.64	1.49	0.910
Observed alcohol outlets	1.05	0.69	1.61	0.813	3.31	0.61	18.01	0.167
Objectively measured alcohol outlets (50m)	0.28	0.03	2.41	0.248	1.70	0.02	145.25	0.815
Objectively measured alcohol outlets (100m)	<i>3.45</i>	<i>2.12</i>	<i>5.63</i>	<i>< 0.001</i>	1.49	0.20	10.87	0.696
Objectively measured alcohol outlets (200m)	<i>2.56</i>	<i>1.95</i>	<i>3.35</i>	<i>< 0.001</i>	0.92	0.24	3.62	0.910

All models adjusted for participant sex, age, and race/ethnicity; italicized estimates denote $p < 0.05$; Vuong tests positive with $p > 0.05$ for all models

^aAlcohol consumption models account for zero-inflation according to alcohol use in baseline survey

^bProblem behaviors models account for zero-inflation according to problem behaviors in baseline survey